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Ministry of Natural Resources
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ONTARIO GEOLOGICAL SURVEY
Open File Report 5375

Grant No. 84 -

Sedimentology of Huronian Deposits, Including Uranium Bearing Rocks

by

Phillip W. Fralick and A.D. Miall

1982

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Fralick, Phillip W., and Miall, A.D.

1982: Sedimentology of Huronian Deposits, Including Uranium Bearing Rocks, Ontario Geological Survey OFR 5375, 35 p., 18 figures and 1 map.

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FINAL REPORT - ONTARIO GEOSCIENCE RESEARCH GRANT #84, "SEDIMENTOLOGY OF HURONIAN DEPOSITS, INCLUDING URANIUM BEARING ROCKS"

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and

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ABSTRACT

Rocks of the Lower Huronian succession (Matinenda, McKim, Ramsay Lake, and Pecors Formations) in the Elliot Lake area can be divided into ten lithofacies: 1) quartz pebble conglomerate assemblages; 2) trough cross-stratified quartzites; 3) planar cross-stratified quartzites; 4) immature sandstones; 5) lenticular bedded units; 6) rhythmites; 7) massive mixtites; 8) bedded mixtites; 9) varved units; 10) massive sandstones and siltstones. Matinenda quartzites and quartz pebble conglomerates were deposited by braided, glacial (?) outwash streams. Marine delta sediments (McKim Formation) are interbedded with Matinenda quartzites in the upper portion of the pre-Ramsay Lake succession. Matinenda fluvial deposition ended as the Ramsay Lake ice sheet advanced into and retreated from the area leaving a layer of glacial debris. Isostatic depression and rebound caused by the ice advance and retreat produced the marine transgression-regression which deposited fine grained material of the prodelta Pecors Formation.

Favourable lithotopes for placer exploration are the lower fluvial rocks of the Matinenda Formation and beach deposits developed where the Matinenda Formation and McKim Formation interbed.

INTRODUCTION

Purpose

Recent work carried out in South Africa by Pretorius (1975), Minter (1976 and 1978), and Smith and Minter (1980) has demonstrated the benefits which can arise from investigating the sedimentology of placer mineral deposits. The uranium occurrences in the Elliot Lake area of Ontario have not previously been subjected to a study using modern sedimentologial techniques similar to those employed in South Africa. Therefore, the study presented here was conducted to investigate the depositional environment of rocks associated with the Huronian placer uranium occurrences and to define favourable depositional environments for the concentration of uranium minerals.

Scope of the Investigation

In the past investigators studying the Huronian succession containing the placer uranium deposits have concentrated on one formation or studied several formations treating each as a separate entity. As formations are defined by lithic differences and many lithic units may be deposited in an area at the same time the practice of studying formation separately may lead to errors in paleogeographic reconstruction. Instead the depositional systems approach put forward by Brown and Fisher (1977) and Mitchum, Vail, and Thompson (1977) was adopted. In this approach lithofacies are grouped into lithofacies assemblages. An example of this would be a fluvial assemblage composed of planar cross-stratified sand, trough cross-stratified sand, ripple laminated sand, and parallel laminated, bioturbated, silty-clay lithofacies. The lithofacies assemblages in turn are combined to form a depositional system, such as a delta being composed of fluvial, interdistributary bay, and prodelta assemblages.

The paleogeography existing around the time of deposition of the ore horizons was investigated with particular emphasis placed on lithofacies interrelationships. The majority of formation boundaries in the area are extremely diachronous. Therefore, in order to use a depositional systems approach to understand the sedimentology in the area it was necessary to study interrelationships between the lowermost four formations of the Huronian Supergroup.

The lateral extent of the investigation was limited to the Quirke Syncline and Chiblow Anticline. By far the most extensive uranium mineralization occurs in this area and abundant surface outcroppings of the basal Huronian facilitate field investigations. To the east of the study area metamorphic grade is generally high, obliterating sedimentary structures, and to the west few outcrops of the basal Huronian exist.

Methodology

Sedimentological studies of clastic rocks can usually be broken down into three components: 1) a study of the depositional environment using gross lithology and sedimentary structures; 2) a study of the drainage or current system using paleocurrent indicators; and 3) a provenance study using studies of detailed lithology. The first two techniques are employed here. The provenance of the uraniferous conglomerates has received considerable study in the past with the most recent work pointing to a coarse grained granitic source (A.G. Robinson, pers. comm., 1981).

Surface outcroppings, mine sections, and core were examined to gather information on the depositional environment. Paleocurrent indicators were analysed using the standard techniques discussed by Potter and Pettijohn (1963). Nomenclature describing sedimentary structures is that in current popular usage unless otherwise cited.

LITHOFACIES

Introduction

To facilitate discussion of the rock units present in the study area they have been subdivided itno a number of lithofacies. The lithofacies are defined using grainsize, bedding characteristics, and sedimentary structures. It must be remembered that most lithofacies types are gradational into one another and that the following discussion describes only the descrete end members of a wide spectrum of variation.

Quartz Pebble Conglomerate Assemblages

Two types of conglomerate occur in the Matinenda Formation. Polymicitic conglomerates usually with dominantly granitic clasts are found as basal lag deposits directly overlying the Archean basement (Figure 1). Oligomictic, quartz pebble conglomerates occur in packages interbedded with quartzites and pebbly quartzites (Figure 2). The oligomictic conglomerates are associated with uranium mineralization and generally contain much higher values than the interbedded quartzites. Heavy mineral bands with abundant uraninite or sometimes present at the base and near the top of the conglomeratic units. Basal contacts are erosional with upper contacts generally sharp, though the conglomerates are sometimes vertically gradational with pebbly quartzites and quartzites. Only very seldom is internal stratification developed in the conglomerates.

Quartzites present in the packages generally have sharp contacts and have a higher lateral thickness variability than the conglomerates. Small and medium scale cross-stratification and ripple lamination dominate the quartzites though they sometimes contain large planar cross-sets with reactivation surfaces. Pyrite often accentuates the ripple and dune cross-lamination.

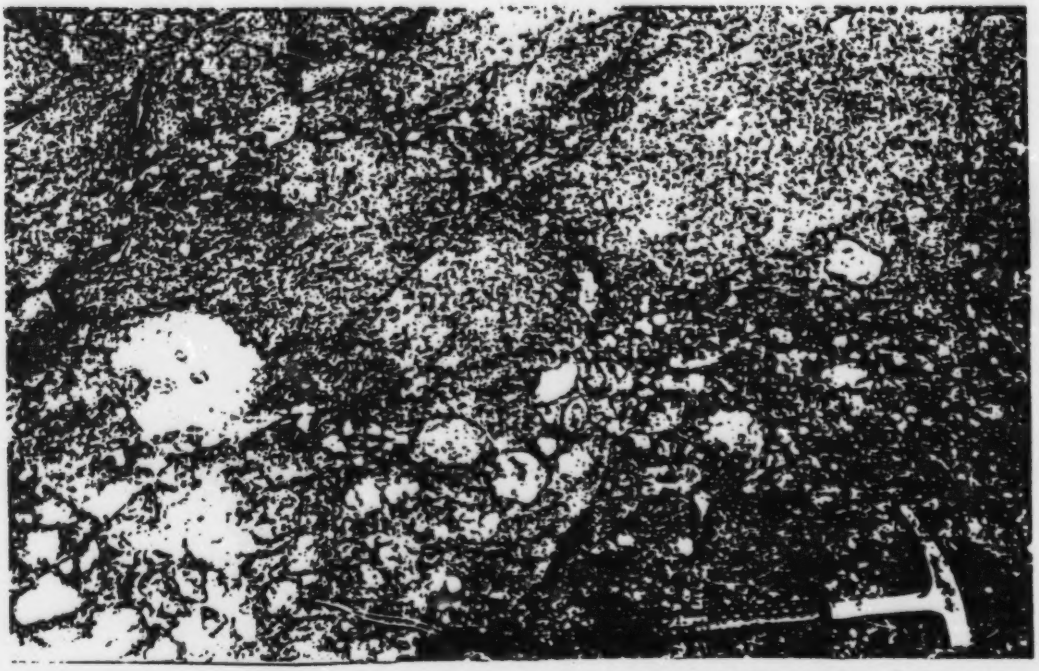


Figure 1. A basal conglomerate of the Matinenda Formation lying unconformably on Archean basement. The clasts are composed of granitic material similar to the adjacent basement. Overturned outcrop near the Pronto Mine.

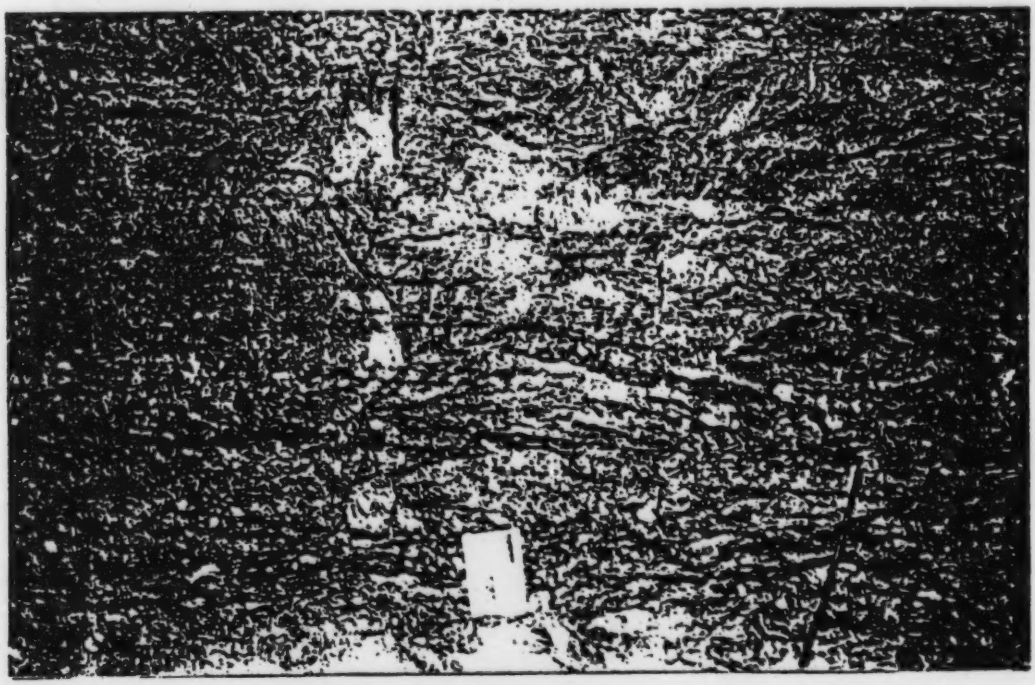


Figure 2 Lower conglomerate reef with overlying pebbly quartzite lenses, Denison Mine.

Oligomictic conglomerate and quartzite are interbedded forming laterally persistent units (up to 4 km x 2 km) in the Matinenda Formation. The blanket-like deposits have a preferred northwest-southwest long axis orientation (Roscoe, 1957; Pienaar 1963).

Trough Cross-Stratified Quartzites

Trough cross-stratified quartzites dominate the strata present in the lower Matindenda Formation (Figure 3). Small and medium scale (less than 30 cm amplitude) trough cross-stratification intermittently interbedded with ripple lamination forms most of the outcrops. Horizontal bedding is almost nonexistent with only the occasional thin mud drape denoting its presence. Instead individual cross-stratified lenses are superimposed forming entire outcrops. Basal contacts of the lenses are erosional and sometimes represent very deep scours. In some areas antidune stratification is common and in one location a previously undescribed very high velocity bedform was found (Figures 4 and 5). Bedforms typical of fluctuating flow conditions are also present (Figure 6). The sand composing the cross-stratified lithofacies is consistently clean and very coarse.

Planar Cross-Stratified Quartzites

Planar cross-stratified quartzites dominate the upper Matinenda Formation. The cross-stratification is medium and large scale, sometimes reaching amplitudes greater than 2 m, and is usually high angle. Reactivation surfaces are quite common (Figure 7). Dirty quartzite drapes, sometimes laterally gradational with silt and shale lenses (Figure 8), separate purer quartzite units. Occasionally the planar cross-stratified quartzites grade laterally into planar cross-stratified dirty (clay rich) sandstones. This lateral transition usually occurs proximal to thick fine grained successions and in some locations interbedding of fine grained units, immature sandstones, and clean planar cross-stratified quartzites

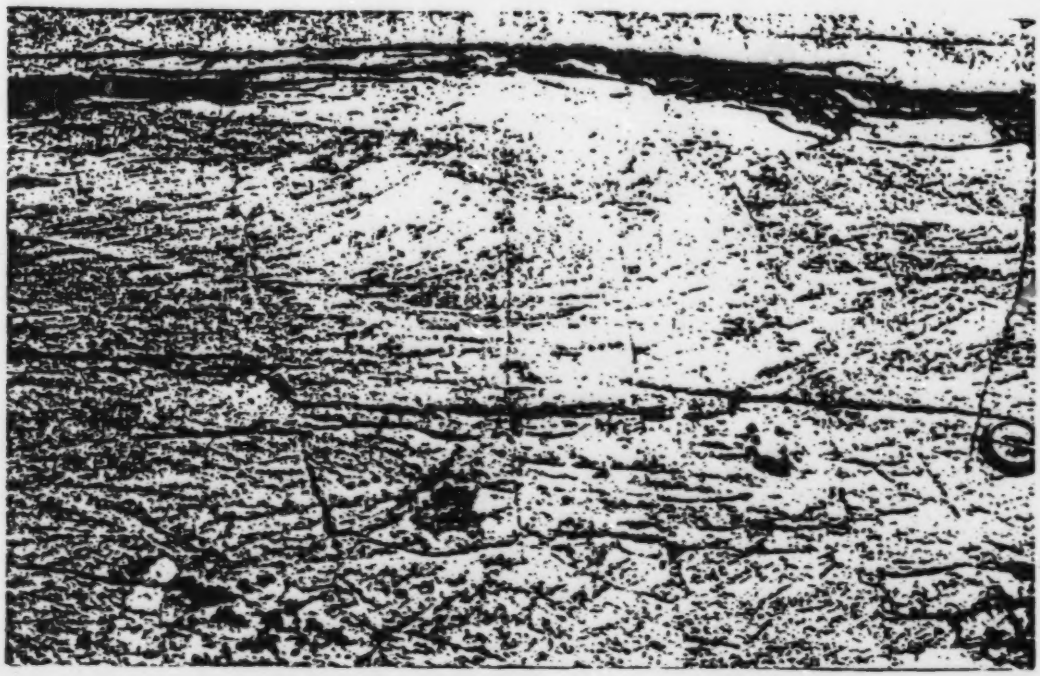


Figure 3 Medium to small scale, trough cross-stratified sandstone of the lower Matinenda Formation near the Pronto Mine Gate.

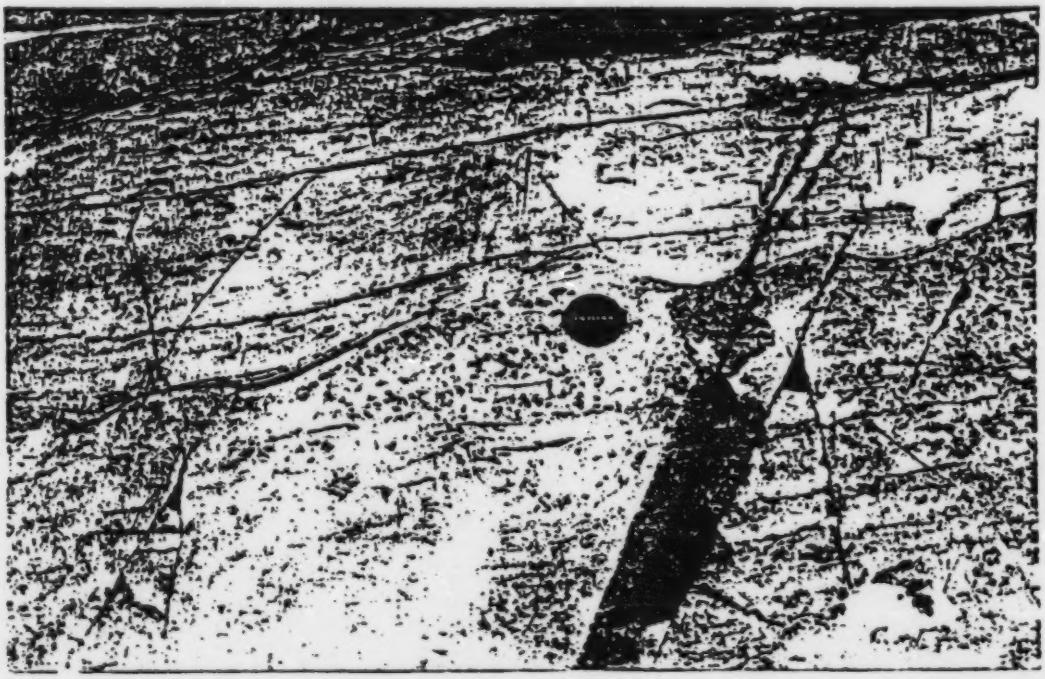


Figure 4 High velocity shoot and pool structure formed along interface between underlying coarse sands and overlying-medium sands. Matinenda Formation west side of Denvic Lake.

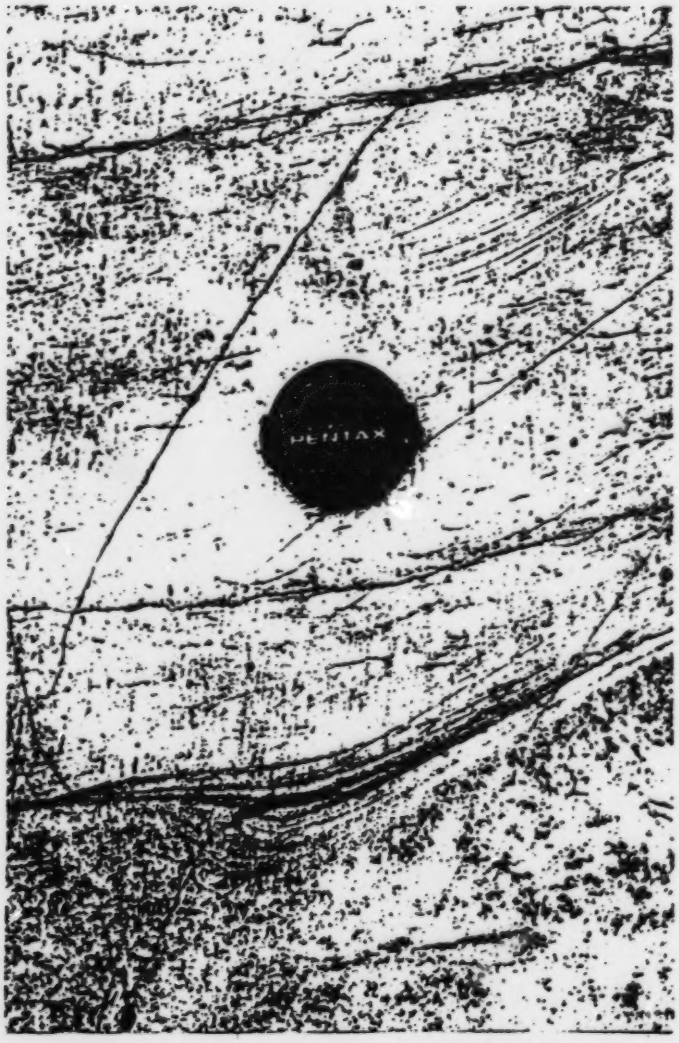


Figure 5 A close-up of a shoot and pool structure separating coarse sand (lower unit) from medium sand (upper unit). Notice the wisps of coarse sand in the trough indicating flow to the right while overlying ripple lamination indicates flow to the left. The shoot and pool structure was probably produced by upstream flow caused by extremely high flow velocities coupled with a variable depth as the flow conditions alternated between rapid and tranquil. This implies that the water depth was probably less than 1 m. Matinenda Formation west side of Denvic Lake.

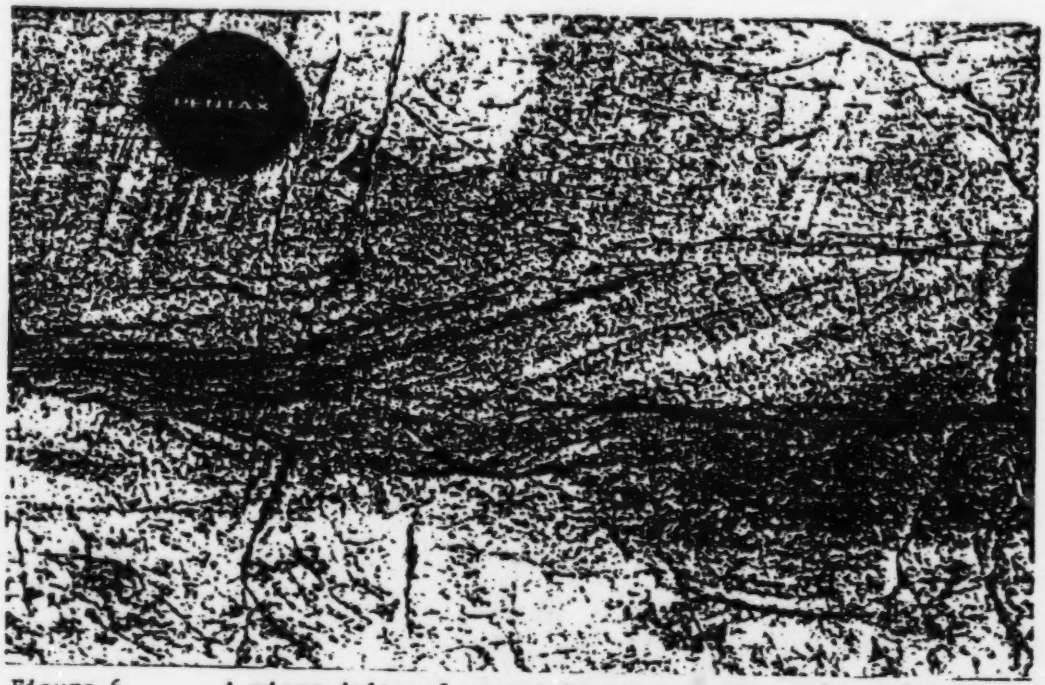


Figure 6 A micro-delta of coarse to very coarse sand overlain by medium sand. The micro-delta was probably developed to reduce a shallow streams water depth in response to a change in the energy conditions of the system. Matinenda Formation west side of Denvic Lake.

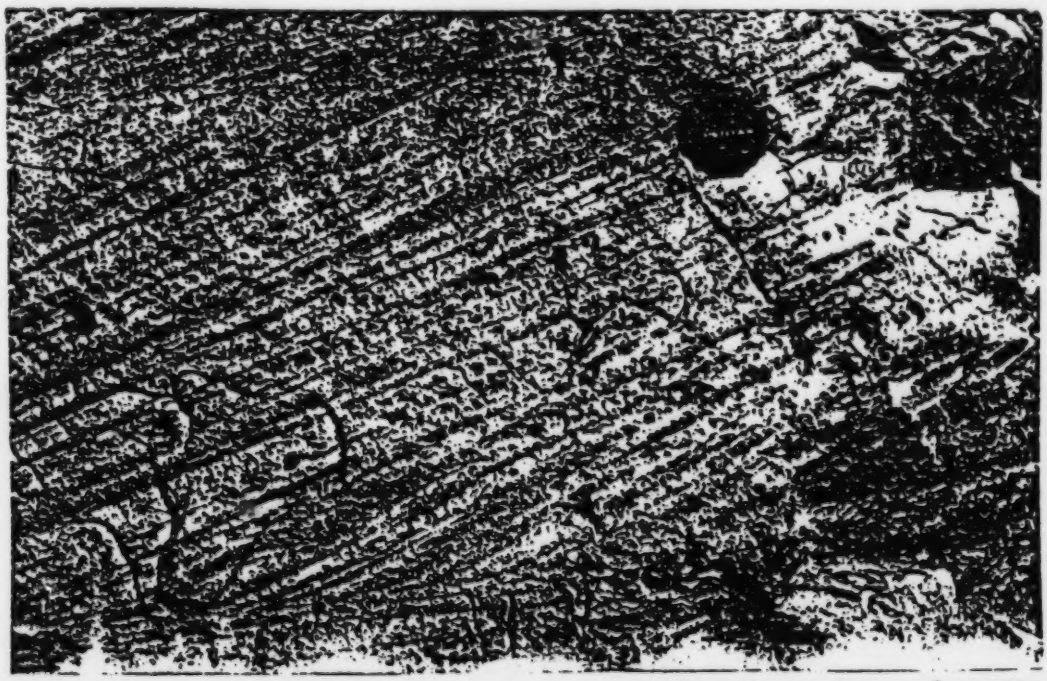


Figure 7 Large scale, planar cross-stratification made up of coarse and medium sand layers and lenses. Note the numerous low angle reactiviation surfaces. Upper Matinenda Formation, west side of Magog Lake.

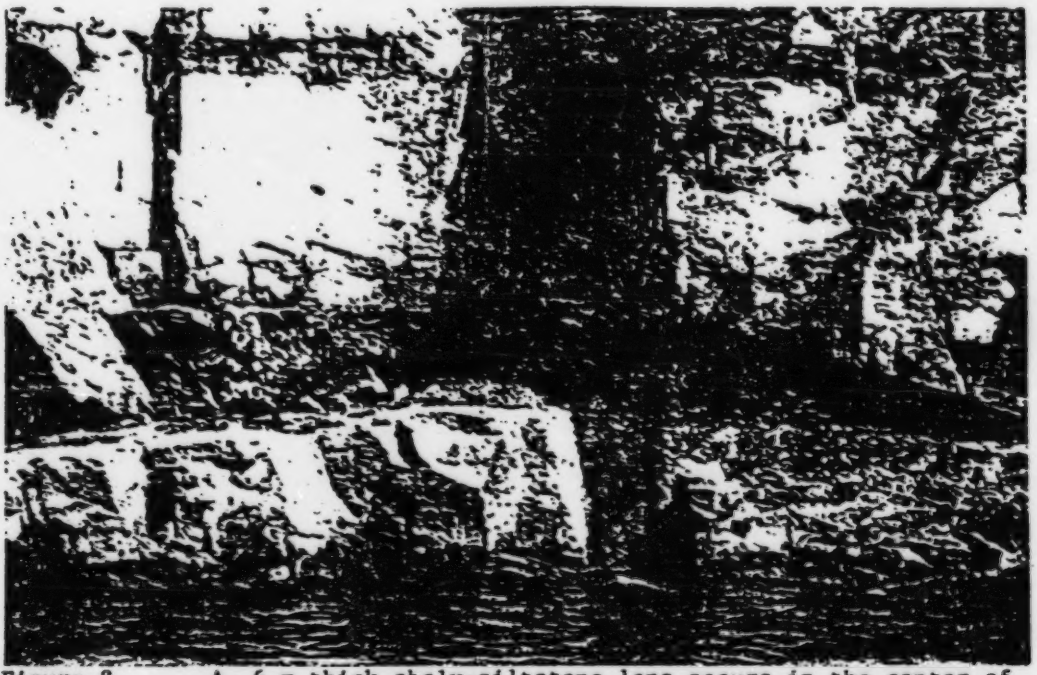


Figure 8 A .6 m thick shaly-siltstone lens occurs in the center of the photo. It extends 16 m to the left where it pinches out and is transitional into a 2 cm thick silty-sand layer which continues to the left separating the two thick sandstone units shown in the photo. The upper sandstone contains large planar cross-sets. Upper Matinenda Formation west side of Magog Lake.

Figure 9 Lenticular bedded units (top and bottim) interlayered with a ripple laminated medium to fine immature sand. Note the high angle slump scar and infilling on left hand side of photo. Pecros Formation, west of Pecors Lake.

occurs. Trough cross-stratified quartzites are also commonly interlayered with planar cross-stratified quartzites.

Immature Sandstones

The immature sandstone lithofacies is composed of dirty (clay rich), fine grained sandstone and does not necessarily contain a high proportion of unstable minerals or rock fragments. Ripple lamination dominates in these units (Figures 9 and 10) though planar cross-stratified and massive bedded assemblages are also sometimes present. The ripple laminated units may show erosive bases (Figure 10) and are internally composed of numerous ripple laminated layers. Mud drapes occasionally separate the ripple lamination producing flaser and wavy bedding (Figures 9 and 11). With the addition of more mud this assemblage can turn into the lenticular bedded lithofacies.

Lenticular Bedded Lithofacies

Lenticular bedded units are commonly interlayered with the immature sandstone lithofacies when fine sands and silts dominate the section (Figures 9 and 11). When clay dominates lenticular bedding is less conspicuous and interlayering with rhythmites occurs. Rows of ripple laminated fine sandstone or siltstone lenses surrounded by shales are the most common structure in the lenticular bedded lithofacies, though all varieties from flaser through wavy to lenticular bedding occur (Figure 12). The ripple laminated sands and silts in these units give a unimodal current direction. With increasing mud content the lenticular bedded lithofacies grades into the rhythmically laminated lithofacies.

Rhythmites

Silt and silty-shale laminations alternate in this lithofacies (Figure 10). Contacts between the millimeter thick laminations appear sharp in hand samples, however, under the binocular microscope the laminations occasionally appear as thin, fining upward units grading from silt to silty-shale. Rare fine sand to coarse silt laminae usually have sharp contacts and sometimes coarsen upward. Indistinct

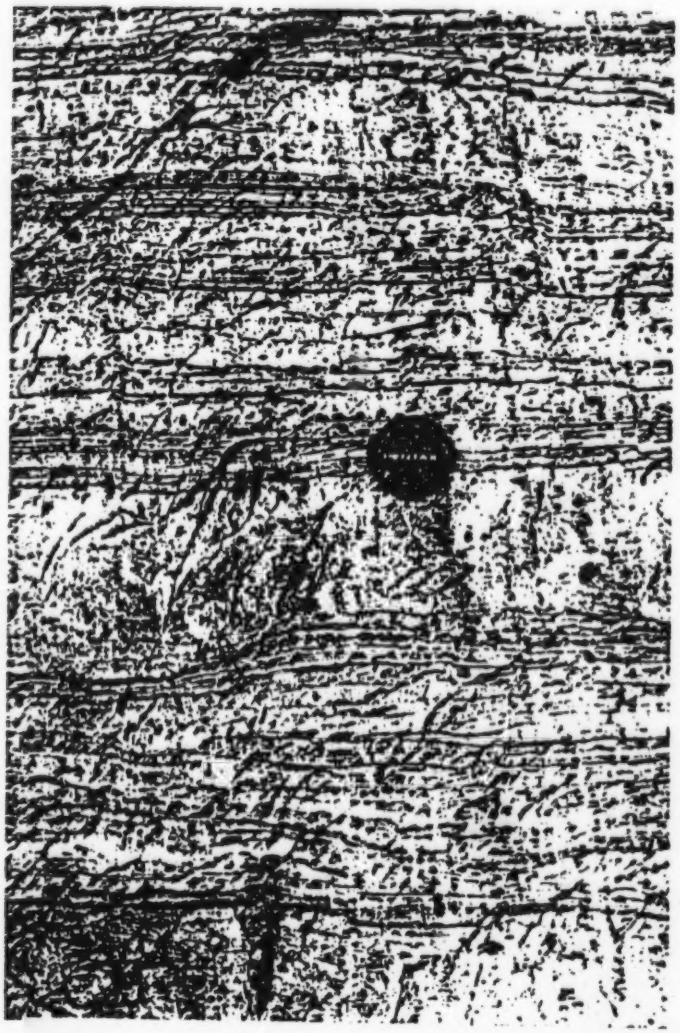


Figure 10 Rhythmically bedded silty-shales to silty-fine sands interbedded with ripple laminated fine sands. Pecors Formation, west side Denvic Lake.

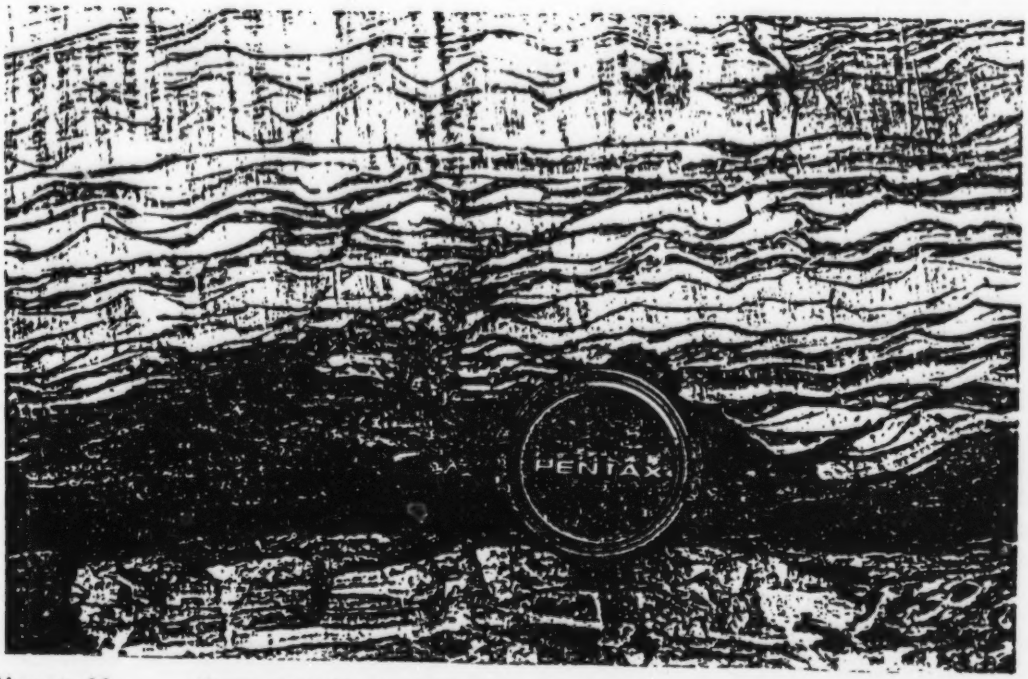


Figure 11 Wavy and flaser bedding in fine sandstones and silty-shales of Matinenda Formation, NE Lauzon Lake.

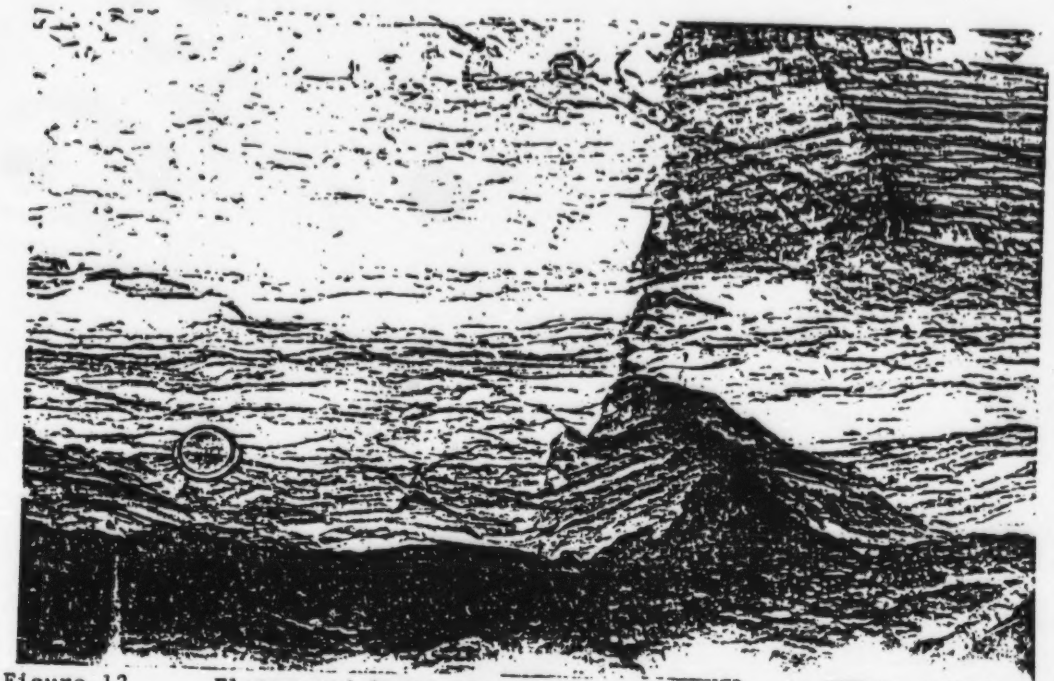


Figure 12 Flaser and lenticular bedding developed in a fine sand and silty-shale succession. Underlying the wavy bedded unit is a massive silty-shale (bottom of photo) and overlying it is a planar cross-stratified coarse sand (not shown). McKim formation, NW corner Magog Lake.

thin ripple lamination is common in thick (greater than 5 mm) silt horizons. Rhythmically laminated units are usually extensively deformed by soft sediment deformation and micro-faulting (Figure 10). The lenticular bedded units and to a lesser extent the immature sandstones are also effected by this type of deformation (Figures 9 and 10). Ball and pillow structures are present in all of these lithofacies. They are formed by the breakup and sinking of overlying massive sands (Figure 13).

Massive Mixtites

One discontinuous horizon of massive mixtite occurs in the lower Huronian of the study area. Its thickness is irregular, varying greatly over small distances and in some areas it is absent altogether, being replaced by banded mixtite to stratified sandstone and conglomerate. In the northernmost section of the study area the clast content of the mixtite is high (Figure 14), while in the south the clast content is very much lower. The southern clast-poor mixtite also differs from the northern mixtite in having less clay, a greater sand sized fraction, and irregular, clast-rich areas. Clasts in both mixtites are predominantly granitic, though locally metavolcanics dominate. Undeformed sedimentary clasts also occur, forming a major portion of the debris in the southern mixtite. In areas where the mixtites overly the clean quartzites of the Matinenda Formation a gradational zone between one and five metres thick in which clay content and pebble size increase separates the two units.

Bedded Mixtites

The massive mixtites in the northern section of the study area are commonly capped by bedded mixtites. The development of internal sedimentary structures formed

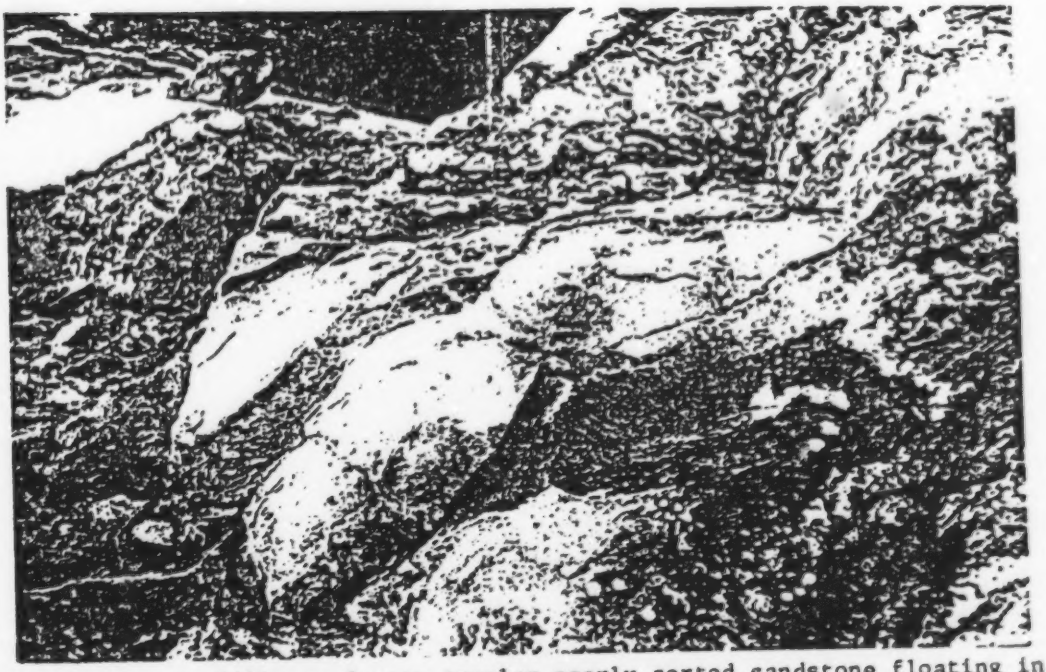


Figure 13 Pillows of very angular poorly sorted sandstone floating in massive silty-shale. All of the 350 x 100 m outcrop is deformed in this manner except a capping succession of Mississagi quartzite. Pecors Formation, S.W. corner of Moon Lake.

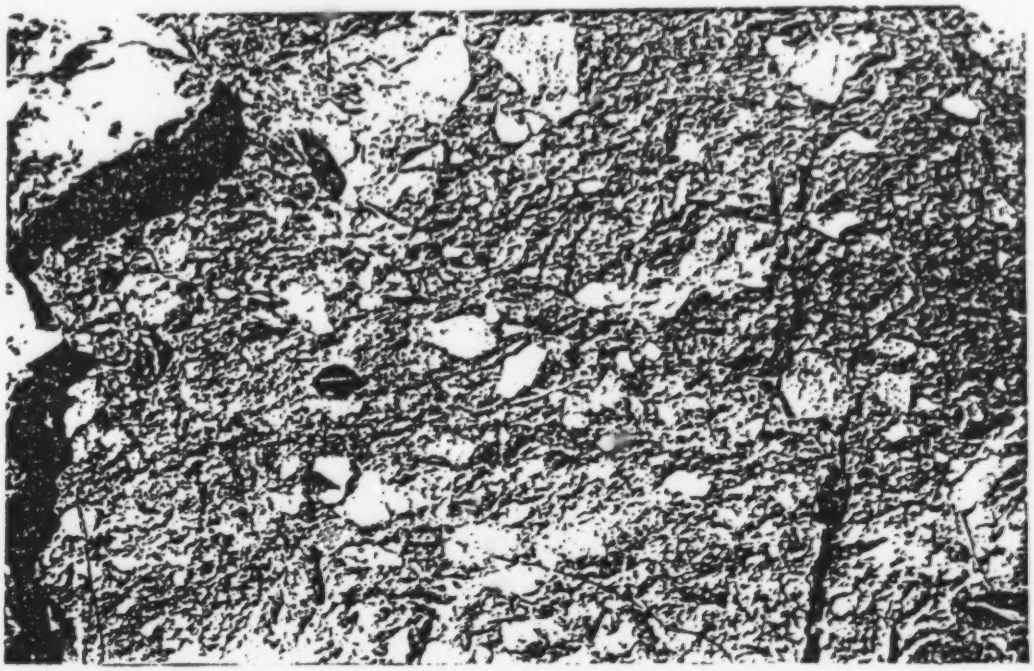


Figure 14 A cobble-pebble mixtite with most of the clasts composed of granitic material. Ramsay Lake Formation, Panel Mine Road.

by unidirectional flow is occasionally associated with the bedding. In the south quartzites containing scattered pebbles and cobbles are interlayered with conglomerates representing bedded mixtites. Irregular masses of coarse material is also sometimes present (Figure 15). Paleocurrent directions obtained from the southern bedded mixtites are consistent with the regional trend.

Varved Units

The distinction between rhythimically laminated units and varved units is very tenuous and some members of the rhythmite lithofacies may very well be varvites. For this reason varved units as used here only refers to units with laminations on the millimeter to centimeter scale that consist mostly of dirty, massive siltstone gradational at the top with a thin layer of shale. Units of this type contain abundant dropstones (Figure 16), are limited in size, and are only found interbedded with massive mixtites in the northern section of the study area.

Massive Sandstones and Siltstones

Massive sandstones and siltstones occur overlying mixtites. The units show extreme lateral thickness variations and assume moundlike shapes in some areas. Grains in the massive sandstones are very angular and a high clay proportion exists in the matrix. Small quartz clasts are sometimes present and rare granite cobbles may also occur.

PALEOCURRENTS

Approximately 350 paleocurrent measurements were collected using trough and planar cross-stratification and ripple lamination. The Matinenda Formation with its wealth of internal structures was the principal unit under investigation with less than ten percent of the measurements coming from the only other units studied -

Figure 15 Lensy, bedded mixtites. Upper Ramsay Lake Formation, W-central Wiskey Lake.

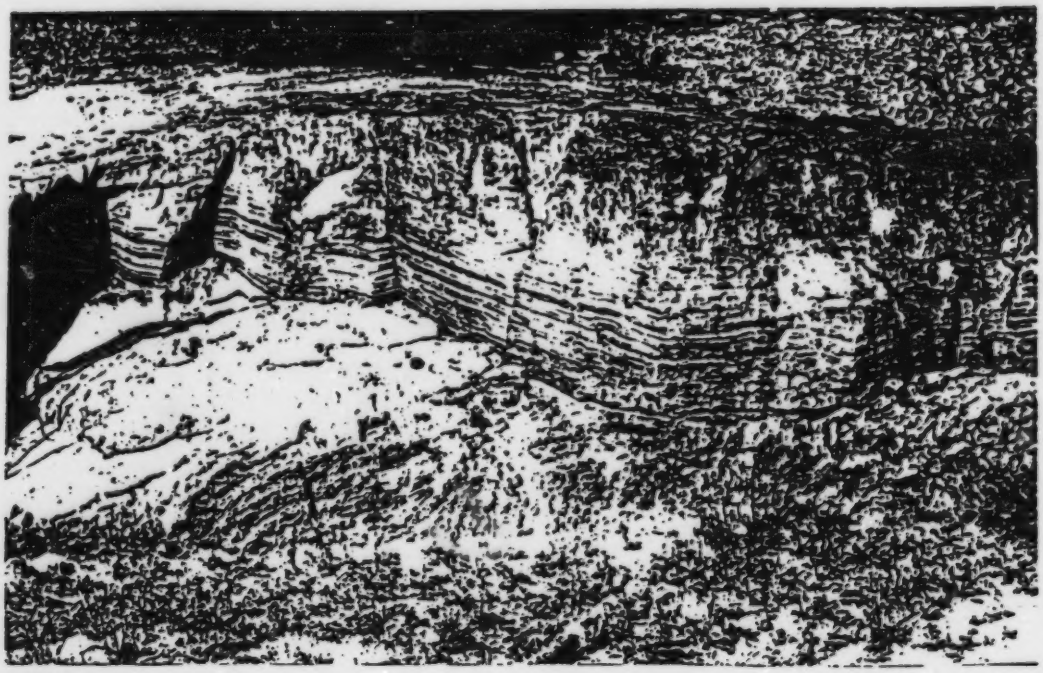


Figure 16 A varved unit overlying the cobble-pebble mixtite of Figure 14. Note the large dropstone in the upper left protion of the photo. Ramsay Lake Formation, Panel Mine Road.

the ripple laminated sitlstones and sandstones of the immature sandstone and lenticular bedded lithofacies.

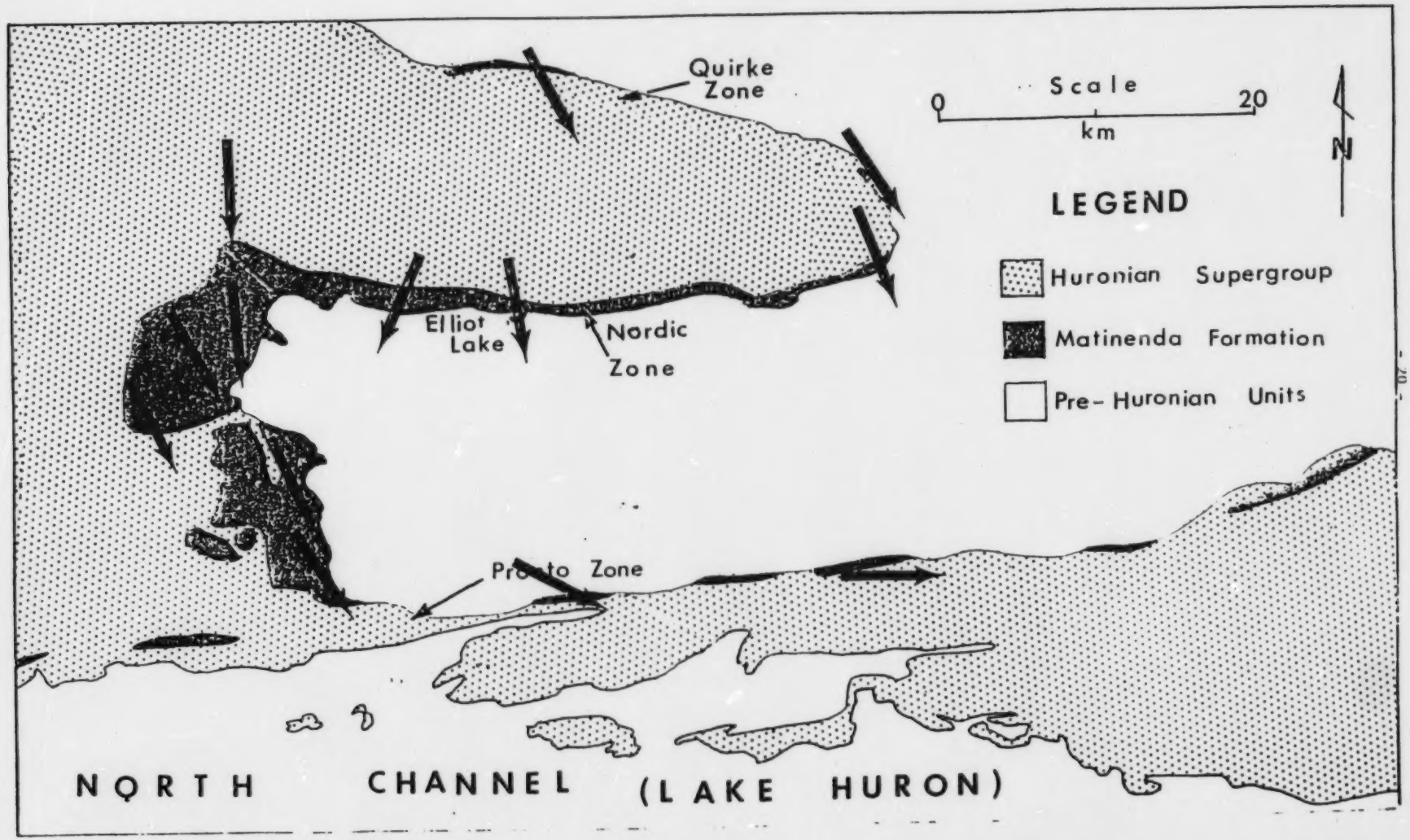
Visual examination of the data (Figure 17) reveals a general trend towards the south-southeast. The trend swings to a more easterly direction with increasing distance down paleoslope. This culminates with the almost directly due east paleocurrent direction derived for the most southerly outcrop studied.

CONCLUSIONS

The Depositional System

After what appears to have been a brief episode of basic volcanism clean quartzites of the Matinenda Formation began to accumulate. The trough cross-stratified lithofacies was probably deposited in braided streams with very large width to depth ratios is indicated by Figures 4 and 5 and the lack of well defined, steep banks. Current velocities were high (Figures 4 and 5) and there is no evidence that the streams were ephemeral in nature, though smaller scale current fluctuations appear to have been very common (Figure 6). Up section this environment is replaced by large scale, planar cross-bedded units the formation of which requires greater water depths than the small and medium scale trough cross-stratified units. The planar cross-bedding formed as transverse bars and sand waves migrated down the larger trunk streams (Cant and Walker, 1976; Miall, 1977). In places sand sheets can be seen interlayered with finer grained units. This association probably represents areas where distributary channels flowed into a standing body of water (Dixon, 1981). The immature sandstone-lenticular bedding-rhythmite succession represents shallow water conditions progressively deepening. Periodic current activity, probably produced by storms (Hawley, 1981), formed the ripple laminated siltstone layers whereas the shale horizons were deposited by continuous rainout of mud.

Figure 17 Paleocurrent data for the Matinenda Formation. Each arrow represents approximately 25 measurements.


Quirke Zone
Elliot Lake
Nordic Zone
Pronto Zone
Scale
0
20
km
N
LEGEND
Huronian Supergroup
Matinenda Formation
Pre-Huronian Units
NORTH CHANNEL (LAKE HURON)

The massive mixtites containing abundant clasts and interbedded with varved (small) lake sediments were probably deposited by a grounded ice sheet. Sandier mixtites containing a lower percentage of clasts and occasionally interbedded with graded turbidites were deposited by rainout from floating ice, some of the clay fraction being removed by winnowing on the way to the bottom and on the bottom. In the north where bedded mixtites are developed immediately overlying grounded tills the bedding can be explained by fluvial reworking of the till. In the south where the reworking is much more intense, and often a massive mixtite does not exist, the reworking may have been caused by strong bottom currents in the standing body of water which had developed in this area prior to Ramsay Lake deposition. The origin of the massive siltstone and sandstone units poses a problem. Their massive nature gives very few clues to their mode of formation. In core sections from the northern outcrop area well sorted massive siltstones directly overlie reworked till and grade into marine silts and silty-shales. This, combined with the angularity of the grains, suggests a reworked glacial origin for the units. They may represent subaqueous outwash from a retreating ice sheet.

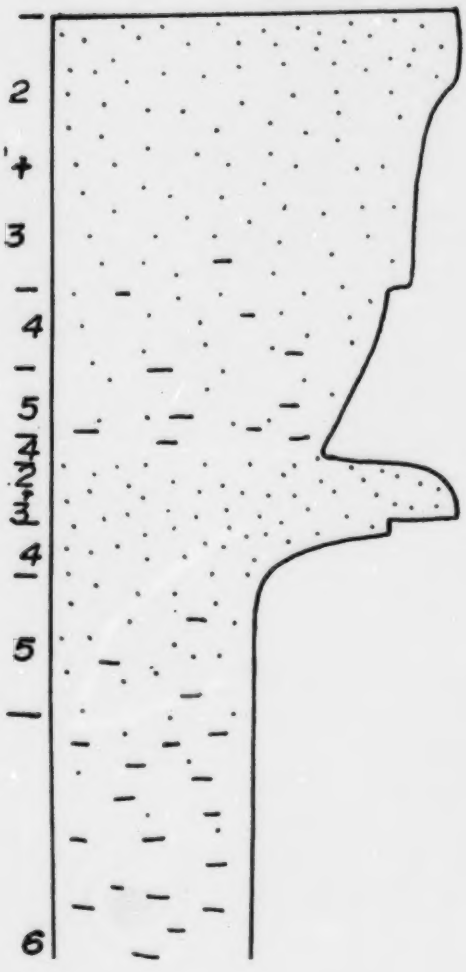
A typical stratigraphic section through the Lower Huronian assemblage is presented in Figure 18. The most likely scenario for the production of the stratigraphic section is presented below.

Following extrusion of basic volcanics glacial outwash originating from a standing ice sheet to the northwest formed the clean coarse sands of the Matinenda Formation. Minor marine or lacustrine floodings into the area probably from the southeast caused interlayering, predominantly in the upper Matinenda with finer grained deposits of the McKim Formation. The rise in base level caused a reduction in slope forcing fluvial systems to deepen and distributary channels to develop. The ice sheet then advanced into the area forming a floating ice shelf approximately south of a line

Figure 18 Typical stratigraphic column for the Lower Huronian succession of the study area. If the McKim Formation were included it would form a proximal prodelta-interdistributary bay assemablage interbedded with the upper Matinenda Formation.

LEGEND

1	Conglomerate - Quartzite Assemblages
2	Trough Cross - Stratified Quartzite
3	Planar Cross-Stratified Quartzite
4	Immature Sandstone
5	Lenticular Bedded Units
6	Rhythmites
7	Massive Mixtite
8	Bedded Mixtite
9	Varvites
10	Massive Siltstone and Sandstone
T	Transition



FORMATION

MISSISSAGI FORMATION

FORMATION

depositional environment

distributary channel

interdistributary bay

distributary channel

prodelta

proximal to

extending from the north end of Wiskey Lake to Matinenda Lake. Subaqueous outwash, glacionatant debris, and rare turbidite assemblages were deposited under the floating ice. As the ice sheet retreated subglacial till and small varved lake deposits accumulated in the north where the ice was grounded. This was accompanied by the immature sandstone-lenticular bedded-rhythmite prodelta lithofaices assemblage rapidly moving in the above order from south to north as water level rose and eventually flooded the entire area to considerable depth. As the next glacial advance began (represented by the Bruce mixtite sheet) water level fell and the Pecors Formation began to coarsen upwards. The cycle is terminated by the advance of possble topset delta, glacial outwash sands of the Mississagi Formation into the area.

Origin of the Placer Deposits

The uranium occurrences so far discovered are limited to conglomerate-sandstone packages in the Matinenda Formation. The association of uraninite with conglomerates can be explained in three ways: 1) the uraninite and quartz pebbles both came from the same source material and thus the uraniferous conglomerate packages represent erosion of small sources and local deposition of the material (mineralization and pebbles genetically linked); 2) the uraninite was deposited in the pores of an openwork gravel due to special hydraulic conditions which were created by the gravel bed (mineralization caused by the pebbles);3) both pebbles and uraninite represent heavy material which only extended down gradient and into the study area during times of intense flow velocity (mineralization and pebbles causatively linked). Arguments can be made against all three of these hypotheses. Contradicting the mineralization and pebbles being genetically linked is the fact that up to 5% of the pebbles in the conglomerates are not quartz (Theis, 1979) but other physically resistant rock fragments that came from differing source terrains. Work carried out by Minter and Toens (1970) contradicts mineralization caused by the pebbles. Using flume experiments they revealed that

magnetite is not preferentially deposited in the pores of an openwork gravel. Evidence against the causitive linkage between mineralization and pebbles is the fact that in intervals if very intense flow recorded by sedimentary structures in the quartzite no pebble horizons are developed. Clearly more research is needed, both in the laboratory (flume experimentation investigating the hydraulics of the system) and in the field (careful three dimensional mapping of conglomerate horizons), before a choice can be made on the factors contributing to the mineralization.

Exploration Targets

The vast majority of exploration carried on in the past has centered on the search for quartz pebble conglomerate horizons in the Matinenda Formation. The development of a predictive model for use in the search for these horizons is difficult as factors causing their formation seem to be variable and localized. However, some guidelines can be set forth. The slope of the land was probably decreasing with time through Matinenda deposition due to a rise in base level. With a lower gradient a decrease in stream energy will occur. Thus, the higher stream energy conditions favourable to uraniferous conglomerate deposition have a much better chance of occurring lower in the Matindenda Formation. The deeper streams present in the upper Matinenda Formation are probably less likely to contain quartz pebble ore horizons. It the ore conglomerates were derived from localized sources with hydraulic conditons not an important factor in thier acccumulation then the above would not hold. In this case sampling the Archean basement underlying the Huronian Supergroup should be carried out with an eye to looking at geochemical trends as an indication of where the original sources may have been located.

The possibility of other types of placer uranium deposits in the area cannot be ruled out. By far the most promising possible deposits are beach placers similar

to the ilmenite placers of the Nile delta (Wassef, 1981). Beaches form an ideal environment for the accumulation of placer deposits because of their constant reworking by waves. Deposits of this type would consist of very well sorted sand probably of a finer grainsize than the usual Matindenda Formation with large scale, low angle, planar cross-stratification sometimes dipping in opposite directions and commonly with pronounced reactivation surfaces. Dune and offshore bar sands may be interbedded with the beach lithosomes. Gravel beaches would probably not be present in this system. The uraninite grains deposited in beach placers would be smaller than those found in the ore reefs and it is unknown if large quantities of fine grained uraninite made it to the Early Proterozoic sea.

Horizons favourable for beach development are those where the Matinenda and McKim Formations are interbedded. These represent the interface between fluvial and marine conditions before glacial ice advanced over the area. Only one possible beach deposits was recognized in the field. It is located on the north-central shore of Lauzon Lake in an area previously mapped as McKim Formation (Robinson, 1970). Here large scale, low angle planar cross-stratified, medium grained, feldspathic sandstones are contained in an interbedded succession which includes fluvial, possibly distributary, clean quartzite and interdistributary bay shales and siltstones. Whispy accumulations of magnetite were evident throughout the feldspathic sandstones. The presence of uranium mineralization in this unit was not tested.

ACKNOWLEDGEMENTS

Grateful appreciation is extended to Mr. Ross Gunning and Mr. Allen MacEachen of Denison Mines Limited for access to underground workings and valuable discussions on the geology of the area.

REFERENCES

BROWN, L.F. and FISHER, W.L., 1977. Seismic-Stratigraphic Interpretation of depositional systems: examples from Brazilian rift and pull-apart basins in, C.E. Payton, ed., Seismic Stratigraphy - Applications to Hydrocarbon Exploration, A.A.P.G. Mem. 26, p. 213-248.

CANT, D.J. and WALKER, R.G., 1976. Development of a braided-fluvial facies model for the Devonian Battery Point Sandstone, Quebec. Can. J. Ear. Sci., vol. 13, p.102-1

DIXON, J., 1981. Sedimentology of the Eocene Taglu Delta, Beaufort-Mackenzie Basin: example of a river dominated delta. G.S.C. paper 80-11.

HAWLEY, N., 1981. Flume experiments on the origin of flaser bedding. Sedimentology vol. 28, p. 699-712.

MIALL, A.D., 1977. A review of the braided-river depositional environment. Earth Sci., Rev. vol. 13, p.1-162.

MINTER, W.E.L., 1976. Detrital gold, uraninite, and pyrite concentrations related to sedimentology in the Precambrian Vaal Reef placer, Witwatersrand, South Africa. Econ. Geol. vol. 71, p. 157-175.

MINTER, W.E.L., 1978. A sedimentological synthesis of placer gold, uranium, and pyrite concentrations in Proterozoic Witwatersrand sediments in A.D. Miall ed., Fluvial Sedimentology. Can. Soc. of Petrol. Geol. Mem. No. 5, p. 801-829.

MINTER, W.E.L. and TOENS, P.D., 1970. Experimental simulation of gold deposition in gravel beds. Trans. of the Geologal. Soc. of. S. Afr., vol. 73, p. 89-98.

MITCHUM, R.M., VAIL, P.R. and THOMPSON, S., 1977. The depositional sequence as a basic unit for stratigraphic analysis, in Payton ed., Seismic Stratigraphy-Applications to Hydrocarbon Exploration. A.A.P.G. Mem. 26, p. 53-62.

PIENAAR, P.J. 1963. Stratigraphy, Petrology, and Genesis of the Elliot Group, Blind River, Ontario, Including the Uraniferous Conglomerate. Geol. Surv. of Can. Bull 83, 143 p.

POTTER, P.E. and PETTIJOHN, E.F., 1963. Paleocurrents and Basin Analysis. Springer, Berlin, 296 p.

PRETORIUS, D.A., 1975. The depositional environment of the Witwatersrand Goldfields- a chronological review of speculations and observations. Minerals Sci. Eng., vol. 7, p. 18-47.

ROBERTSON, J.A., 1970. Long and Spragge Townships and part of Indian Reserve No. 7, Algoma District. Ont. Dept. of Mines, map 2186.

ROSCOE, S.M., 1957. Geology and uranium deposits, Quirke Lake - Elliot Lake, Blind River, Ontario. Geologic Survey of Canada, Paper 56-7.

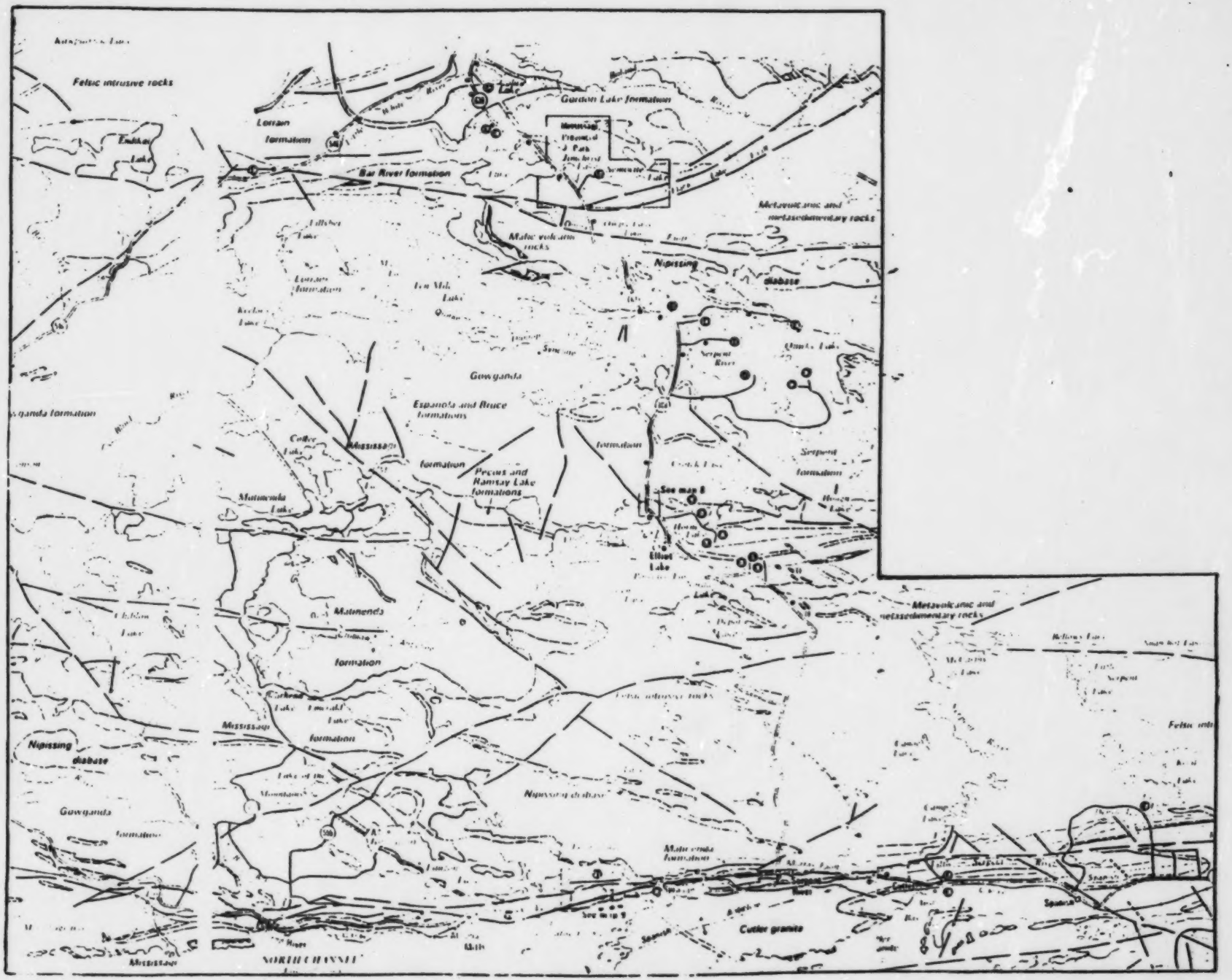
SMITH, N.D. and MINTER, W.E.L., 1980. Sedimentological controls of gold and uranium in two Witwatersrand paleoplacers. Econ. Geol., vol. 75, p. 1-14.

THEIS, N.J., 1979. Uranium-bearing and associated minerals in their geochemical and sedimentological context, Elliot Lake, Ontario. G.S.C., Bull. 304, 50 p.

WASSEF, S.M., 1981. Distribution and properties of placer ilmenite in East Rosetta beach sands, Egypt. Mineral. Deposita, vol. 16, p. 259-267.

APPENDIX 1

LOCATION MAP


Felsic intrusive rocks
Lorrain formation
Bar River formation
Gordon Lake formation
Mafic volcanic rocks
Metavolcanic and metasedimentary rocks
Nipissing diabase
Gowganda
Espanola and Bruce formations
Cutler
Mississagi formation
Pecors and Ramsay Lake formations
Serpent formation
See map 1
Elliot Lake
Matinenda formation
Cutler granite
NORTH CHANNEL